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A DRIVE FOR SPACE

A new type of electrical engine for space flight is being studied at the University of Illinois by Professor Charles D. Hendricks, Jr. The investigation, being conducted in cooperation with the Thompson Ramo Wooldridge Corporation, is primarily concerned with the basic physics of liquid metals for use as working fluids in thrust-producing engines. Experiments involve placing an electrical charge on tiny droplets of liquid metals, enabling the droplets to be accelerated by electrical fields to propel a vehicle in space as do exhaust gases from an ordinary rocket.

Professor Hendricks has just returned to the project from visiting research laboratories in Tokyo, Calcutta, Rome, and Paris. During this trip he addressed the Japanese Rocket Society in Tokyo and gave seminars at two science institutes in Calcutta. The seminars were devoted to discussions of experimental work in gaseous electronics and plasma physics in the University of Illinois Electrical Engineering Department.

FIGHTING HEAT WITH ADHESIVES

One of the greatest problems faced today by designers of high speed aircraft and rockets is finding materials which are strong, light, and heat resistant. One group of researchers in the U. of I. Department of Ceramic Engineering, directed by Professor D. G. Bennett, has found a promising solution in metal panels laminated to honeycomb layers by glassy bond and air setting adhesives.

Such panels honeycombed with organic adhesives will not resist temperatures much above 500° F., but this study is primarily concerned with inorganic adhesives which, while very strong, will permit the panels to withstand over 1000° F. at several thousand psi in tensile shear for extended periods of time. Professor Bennett points out that the program is now based on a target temperature of 2000°, and that progress is being made toward solving this problem which now stands in the path of astronautics and rocketry.

TWO KINDS OF SPACE FOR AERONAUTICAL ENGINEERING

Space travel has put the aeronautical engineer into the international limelight. Missiles and space ships have become a matter of national policy and prestige, and perhaps of national survival.

With the largest undergraduate enrollment in aeronautical engineering in the United States, the Aeronautical Engineering Department at the University of Illinois is vitally concerned with keeping its teaching and research programs up to date with the latest developments in the field. This country's continued progress in aircraft, missiles, and spacecraft is dependent on a supply of young engineers trained to handle tomorrow's problems as they arise.

Another kind of space problem stands in the way, however, and this one can't be solved by aeronautical research. In its sixteen years of operation, the Aeronautical Engineering Department has had only "second-hand" laboratory and office space given to it from the overcrowded facilities of the other engineering departments. Their offices are in the Transportation Building and their laboratories and shop space are in the old Locomotive Laboratory and the old Machine Tool Laboratory. Six miles away, at the University airport, the Department has two Quonset huts.

A recent departmental report comments that the two laboratory buildings on the campus were no longer adequate for the purposes for which they *were* designed, so the Aero Department is now trying to use them for purposes for which they *were not* designed. Low pressure air sources are at the airport and high pressure air sources are six miles away on the main campus, so both cannot be readily used for the same set of tests. Laboratory work is frequently severely limited in power and capacity.

The Department's research program is closely coordinated with teaching. Members of the faculty have been associated with missile development for several years. Research under way at present includes hypersonic

aerodynamics, plasma physics, magnetogasdynamics, high-temperature structures, aircraft performance and stability, and propulsion systems. This includes highly theoretical studies of interplanetary flight.

To maintain its teaching and research program at the forefront of knowledge in the field, the Department has requested its own building for laboratories, offices, and classrooms. This is to include such essential laboratory facilities as low, medium, and high pressure air supplies, vacuum systems, high temperature sources, and adequate energy supplies. Funds are not now available, but they may become available early enough to prevent further delay in the development of aeronautical engineering at the University of Illinois if the Universities Bond Issue is approved by the voters next November.

The Universities Bond Issue will not specify the buildings to be built, or even how much money goes to each university. But it will make funds available for allocation by the State Assembly for needed buildings on the campuses of Illinois' universities. With such funds available, the acute needs of the Aeronautical Engineering Department will be a step nearer to being met. The passage of the Universities Bond Issue will be a step toward assuring that our progress into outer space

will not be delayed by lack of teaching space right here on earth.

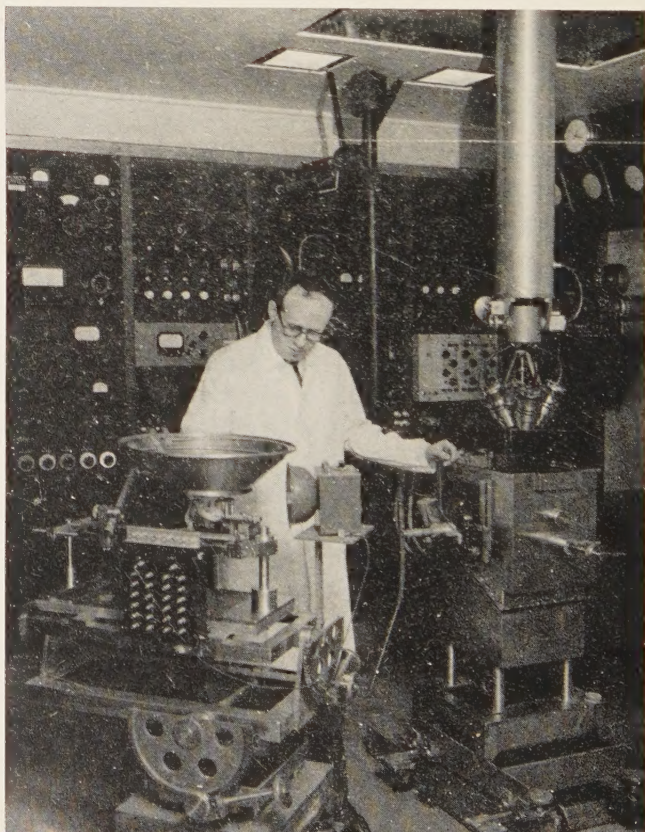
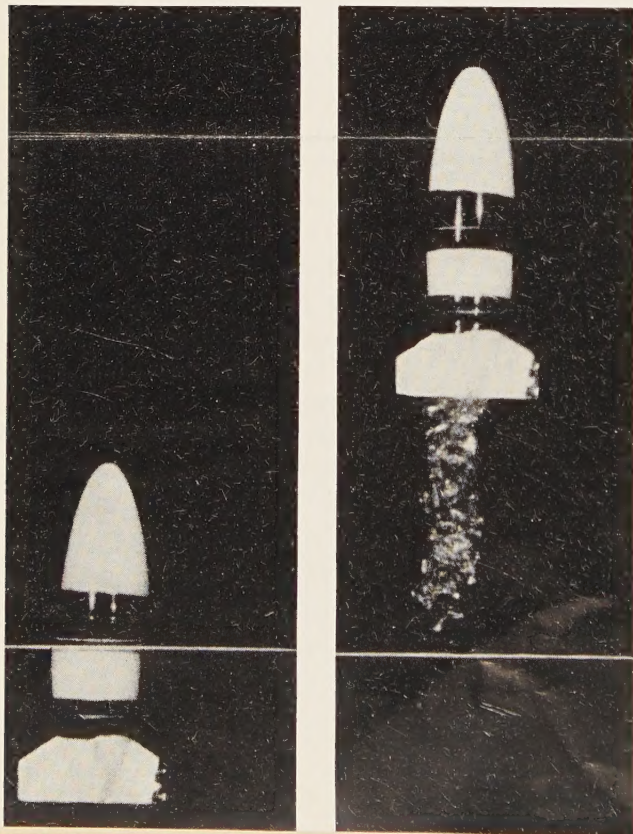
A SILENT SOUND FOR SURGERY

The Biophysical Research Laboratory of the Electrical Engineering Department has discovered that high intensity focused ultrasound can be used, under precisely controlled dosage conditions, to produce selective changes in the central nervous system. This discovery provides a new method of performing brain operations. Both research on experimental animals and ultrasonic human neurosurgery are in progress at the present time, the latter work being carried out in collaboration with the Division of Neurosurgery of the State University of Iowa. Work being done at the University of Illinois, directed by Dr. William J. Fry, consists of dosage, anatomic, and behavioral studies on large animals.

The instrumentation for this work, as well as the basic discoveries on experimental animals, was developed at the University of Illinois. It is the first system that permits precision ultrasonic irradiation of biological systems in the megacycle per second frequency range at high intensity levels. Ultrasonic techniques show great promise in brain surgery techniques, three dimensional

High-speed motion pictures, taken at 1,000 frames per second, reveal that as a missile-shaped body passes from water to air there is little surface disturbance, slight effect on speed or direction, but considerable water exiting with the missile. Photos show (left) a model 4 inches long passing from water to air, (right) the model after exit from the water. This study of water exit hydroballistics is being done by Professors James M. Robertson and Marlyn E. Clark of the Department of Theoretical and Applied Mechanics. The research is sponsored by the Navy's Office of Naval Research.

Professor William J. Fry is shown with a portion of the instrumentation for focused ultrasonic beam irradiation of selected regions of the brain. The four-beam focusing irradiator is shown mounted on a tube projecting through the ceiling of the room. This tube supports and moves the irradiator. Electronic control instrumentation is shown mounted in the wall in the background. The calibration tank is in position immediately below the irradiator. The pan which supports the degassed sterile solution which acts as a transmitting medium for the sound is shown in position over the skull.



mapping of brain mechanisms, resolving micro-structures by means of ultrasound microscopes, and treatment of such disorders as Parkinson's disease, cerebral palsy, and intractable pain of patients with phantom limb and amputation stump pains. One of the current projects involves the study of tumor control through ultrasound irradiation.

NUCLEAR ENGINEERING STUDENTS SPONSORED

Eight graduate students in nuclear engineering at the University of Illinois attended the sixth annual meeting of the American Nuclear Society in June with the sponsorship of ANS and interested private companies. The sponsoring companies were the Commonwealth Edison Company of Chicago, General Atomic Division of General Dynamics of San Diego, *Nucleonics* magazine of New York, and the Nuclear Development Corporation of America, White Plains, New York. The financial aid allowed the students to attend two days of the meeting.

BRITTLE FRACTURE MECHANICS

Under certain conditions some structural steels fracture with a very small amount of deformation and a correspondingly small amount of energy absorption. During the past fifty years many structures, including ships, oil storage tanks, pressure vessels, and bridges, have failed suddenly and catastrophically in this manner. Such brittle fractures have been studied for a long time in the University of Illinois Civil Engineering Department. A research group directed by Professor W. J. Hall is presently conducting a fundamental investigation to identify the significant parameters associated with the propagation of brittle fractures. The most recent studies have involved measuring the strain field surrounding the tip of a propagating fracture and the fracture speed in wide steel plates. Reports describing this work are available from the Ship Structure Committee, National Academy of Sciences—National Research Council, Washington 25, D.C.

WORKING ON THE RAILROADS

All railroads in the United States and Canada send rails which have failed to the University of Illinois Theoretical and Applied Mechanics Department for examination. The University has a great deal of experience in this field, having instituted a program of railroad engineering back in 1898.

The method of investigating rail failure specimens is both mechanical and metallurgical. In the past year alone twenty-five reports were prepared for different

railways, showing seventeen different causes for the failures. The ultimate goal of such investigations is the prevention of such failures through the use of better materials and design features.

Reprint No. 61, "Progress Reports of Investigation of Railroad Rails," by Professor R. E. Cramer has just been published, summarizing the investigations and findings of 1959 and describing testing apparatus and methods at the University of Illinois. It is available for fifty cents from the Engineering Publications Office, 114 Civil Engineering Hall, University of Illinois, Urbana.

ENGINEERING MECHANICS SYMPOSIUM

The first class in the new engineering mechanics curriculum at the University of Illinois was graduated in June. The fifteen men in the class culminated their studies on June 4 with the First Senior Symposium on Engineering Mechanics. At the Symposium, seven papers were presented by graduating seniors. These papers were on free torsional vibration of an elastic cylindrical bar mounted in a continuous elastic support, a discussion of the triaxial state of stress in an extremely thin brazed joint, the effect of biaxial stresses on rapid crack propagation, the soap film and its application, analysis of the influence of initial crookedness on column strength, specific work as a criterion for simple shear strain definition, and free vibration of a continuum with damping characteristics.

A limited number of copies of the papers in this program are available as Theoretical and Applied Mechanics Report 165.

DRAFTING TIME IS MONEY TOO

Engineering drawing has a number of fundamental traditions, among which are the methods of transferring measurements between orthographic views, the arrangement of these views, and the manner of drawing isometrics. Professor Wayne L. Shick of the University of Illinois Department of General Engineering has devised a new drafting system which allows *direct* projection between front, top, side, and isometric views.

An improvement on traditional methods, the United Drawing System permits more accurate drawings to be made with less time and effort. Isometric and orthographic views are integrated, making the isometric projection a direct check on the orthographic views. The movable part of the system is simply a plastic quadrangle which operates against three fixed guide strips. The University of Illinois Foundation has applied for a patent on the device.

The United Drawing System was presented at the an-

nual meeting of the American Society for Engineering Education in June 1960. The system will be published in the leading drawing texts in 1961. Requests for further information may be directed to Professor W. L. Shick, 210 Transportation Building, University of Illinois, Urbana.

WOMEN ENGINEERS

Miss Leone Murphy of Bellwood, Illinois, proved this June that the College of Engineering at the University of Illinois is not strictly the domain of the male student. She did this by graduating with a bachelor's degree in ceramic engineering. In five years at the University, she managed to also include some of the courses more conventionally taken by women in college. These included classics, mythology, ancient history, Greek tragedy, economics, accounting, and home economics.

Although she was the only woman graduating in engineering this June, Miss Murphy was not the only woman in the College of Engineering. During the 1959-60 academic year there were 12 women enrolled in the College.

GRANT AIDS HIGH PRESSURE STUDIES

A \$50,000 unsolicited and unrestricted research grant has been awarded to Professor Harry G. Drickamer of the

Chemical Engineering Department by the American Chemical Society. This grant-in-aid is given to support the work of an outstanding scientist selected for accomplishments in basic research. Professor Drickamer is internationally known for his work on properties of matter at high pressure. His group has developed apparatus to study materials optically at over 200,000 atmospheres.

The \$50,000 grant will be used to support an extension of this work in the future.

AN ENCYCLOPEDIA OF WELDED STRUCTURE FATIGUE

A book discussing the available information and conclusions on the fatigue strength of welded structural connections is being written by Professor W. H. Munse. The result of a study for the Welding Research Council, the book should serve as a comprehensive guide for engineers who are concerned with the fatigue of welded structures. Publication plans are still indefinite.

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